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This chart contains a history of this ITRM publication’s revisions:

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<th>Purpose of Revision</th>
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<td>To correct grammatical error, change title description for PPA director, and to add COV to guideline title. None of these changes altered the substance and meaning of the guideline.</td>
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Review Process

Technology Strategy and Solutions Directorate Review

N. Jerry Simonoff, VITA Director of Information Technology Investment and Enterprise Solutions (ITIES), and Chuck Tyger, Director for Policy, Practices, and Architecture Division, provided the initial review of the report.

Agency Online Review

The report was posted on VITA’s Online Review and Comment Application (ORCA) for 30 days. All agencies, stakeholders, and the public were encouraged to provide their comments through ORCA. All comments were carefully evaluated and the individual commenters were notified of the action taken.
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(Authority of Agency Directors)

Code of Virginia, §§ 2.2-2005 – 2.2-2032.
(Creation of the Virginia Information Technologies Agency; “VITA;” Appointment of Chief Information Officer (CIO))

Scope
This Guideline is offered as guidance to all Executive Branch State agencies and institutions of higher education (collectively referred to as “agency”) that manage, develop, purchase, and use information technology (IT) resources in the Commonwealth.

Purpose
To guide agencies in the implementation of the information technology contingency planning requirements defined by ITRM Standard SEC501-01.

General Responsibilities
(Italics indicate quote from the Code of Virginia)

Chief Information Officer
In accordance with Code of Virginia § 2.2-2009, the CIO is assigned the following duties: "the CIO shall direct the development of policies, procedures and standards for assessing security risks, determining the appropriate security measures and performing security audits of government databases and data communications. At a minimum, these policies, procedures, and standards shall address the scope of security audits and which public bodies are authorized to conduct security audits."

Chief Information Security Officer
The CIO has designated the Chief Information Security Officer (CISO) to develop Information Security policies, procedures, and standards to protect the confidentiality, integrity, and availability of the Commonwealth of Virginia’s IT systems and data.

IT Investment and Enterprise Solutions Directorate
In accordance with the Code of Virginia § 2.2-2010, the CIO has assigned the IT Investment and Enterprise Solutions Directorate the following duties: "Develop and adopt policies, standards, and guidelines for managing information technology by state agencies and institutions."

All State Agencies
In accordance with §§ 2.2-603, § 2.2-2005, and § 2.2-2009 of the Code of Virginia, all Executive Branch State agencies are responsible for complying with all Commonwealth ITRM policies and standards, and considering Commonwealth ITRM guidelines issued by the Chief Information Officer of the Commonwealth.

Definitions
Agency All Executive Branch State agencies and institutions of higher education that manage, develop, purchase, and use IT resources in the Commonwealth of Virginia (COV).

Agency Control - If an agency is the Data Owner of the data contained in a Government database, that agency controls the Government database.

BIA - Business impact analysis – The process of determining the potential consequences of a disruption or degradation of business functions.

COOP – Continuity of Operations Plan – A set of documented procedures developed to provide for the
continuance of essential business functions during an emergency.

Data - Data consists of a series of facts or statements that may have been collected, stored, processed and/or manipulated but have not been organized or placed into context. When data is organized, it becomes information. Information can be processed and used to draw generalized conclusions or knowledge.

Database - a collection of data organized into interrelated tables and specifications of data objects.

Data Communications - Data Communications includes the equipment and telecommunications facilities that transmit, receive, and validate COV data between and among computer systems, including the hardware, software, interfaces, and protocols required for the reliable movement of this information. As used in this Guideline, Data Communications is included in the definition of government database herein.

Data Owner - An agency manager responsible for the policy and practice decisions regarding data. For business data, the individual may be called a business owner of the data.

Government Database: For the purposes of this document, the term “government database” includes both databases that contain COV data and data communications that transport COV data. This definition applies irrespective of whether the COV information is in a physical database structure maintained by COV or a third-party provider. However, this definition does not include databases within Agencies that have been determined by the Agencies themselves to be non-governmental. See also Database and Data Communications.

Information Security Officer (ISO) - The individual who is responsible for the development, implementation, oversight, and maintenance of the agency’s IT security program.

IT System - An interconnected set of IT resources and data under the same direct management control.

Sensitive Data - Any data of which the compromise with respect to confidentiality, integrity, and/or availability could adversely affect COV interests, the conduct of agency programs, or the privacy to which individuals are entitled.

Sensitive IT Systems - COV IT systems that store, process, or transmit sensitive data.

System Owner - An agency Manager responsible for the operation and maintenance of an agency IT system.

Threat - Any circumstance or event (human, physical, or environmental) with the potential to cause harm to an IT system in the form of destruction, disclosure, adverse modification of data, and/or denial of service by exploiting vulnerability.

Vulnerability: A condition or weakness in security procedures, technical controls, or operational processes that exposes the system to loss or harm.

Related ITRM Policy and Standards
ITRM Policy, SEC500-02, Information Technology Security Policy (Effective 07/01/2006)
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1 Introduction

1.1 Information Technology Security

In order to provide overall Information Technology (IT) security that is cost-effective and risk based, data protection must be a part of an agency’s comprehensive risk management program. This Guideline presents a methodology for data protection suitable for supporting the requirements of the Commonwealth of Virginia (COV) Information Technology Resource Management (ITRM) Information Technology Security Policy (ITRM Policy SEC500-02), the COV ITRM Information Technology Security Standard (ITRM Standard SEC501-01), and the COV ITRM Information Technology Security Audit Standard (ITRM Standard SEC502-00). These documents are hereinafter referred to as the “Policy,” “Standard,” and “Audit Standard,” respectively. Agencies are not required to use this guideline, and may use methodologies from other sources or develop their own methodologies, provided that the methodologies implement the requirements of the Policy and the Standard.

1.2 Data Protection

1.2.1 Sensitive Data

Sensitive data is data which, if compromised with respect to confidentiality, integrity, or availability, could adversely affect COV interests, the conduct of agency programs, or the privacy to which individuals are entitled. Data is classified as sensitive if compromise of that data results in a material and significant adverse affect of COV’s interest, the inability of the affected agency to conduct its business, and breach of privacy expectations. Data sensitivity classification is determined by the agency, and is the responsibility of the Data Owner, as defined in the COV ITRM Risk Management Guideline (ITRM Guideline SEC506-00).

1.2.2 Risks to Data

As shown in Figure 1, risks to data occur when threats combine with vulnerabilities to enable a compromise of confidentiality, integrity, or availability of data. For example, theft of sensitive data stored on an agency laptop is a threat. If agency employees are allowed to take laptops
home, data stored on the laptops is vulnerable to theft. One resulting risk is agency data residing on laptops taken home may be compromised if the laptop is stolen.

Figure 1 - Threat Formation

1.2.3 Special Precautions for Sensitive Data Storage

All stored data should be protected commensurate with sensitivity and risk. When sensitive data is stored on an electronic, magnetic, or optical data storage medium, the medium requires protection commensurate with this sensitivity and risk, as illustrated in Figure 2, and described in the remainder of this Guideline. Section 6 of the Standard requires, in particular, that sensitive data not be stored on a mobile data storage medium unless there is documented agency business necessity and description of mitigating controls approved in writing by the Agency Head (see also Section 3.1.2 of this Guideline).

Figure 2 - Data Protection Requirements
1.2.4 **Special Precautions for Sensitive Data in Transmission**

The Standard defines data protection requirements only for stored data. Agencies are strongly encouraged, however, to provide protection for data in transmission, commensurate with sensitivity and risk. A common means of protecting sensitive data in transmission is through encryption; data encryption technologies are discussed in Section 4 of this Guideline.

1.3 **Documentation of Agency Practices**

Section 6 of the Standard requires agencies to document data protection practices. The elements of such practices should describe, at a minimum:

- Roles and Responsibilities
- Relationship to agency privacy policies
- What must be protected
- Data storage protection practices
- Data encryption practices

The remainder of this document provides guidance for meeting these requirements.
2 Key Data Protection Roles and Responsibilities
While all users and managers of agency data have responsibilities for its protection, there are key roles that should be described in the agency’s data protection practices.

2.1 Data Owner
The Data Owner is the agency manager responsible for the policy and practice decisions regarding the data to be protected. A Data Owner must:

- Evaluate and classify sensitivity of the data. This classification should occur as part of IT system and data sensitivity classification.¹
- Define protection requirements for the data based on the sensitivity of the data, any legal or regulatory requirements, and business needs.
- Define requirements for access to the data.
- Communicate data protection requirements to the System Owner.

A template and example for documenting data sensitivity, and data protection and access requirements is contained in Appendix A; a template and example for communication data protection requirements to the System owner is contained in Appendix B.

2.2 Data Custodian
A Data Custodian is any individual or organization in possession of data for Data Owners. Data Custodians must:

- Protect the data in their possession from unauthorized access, alteration, destruction, or usage.
- Establish, monitoring, and operating IT systems in a manner consistent with COV IT and agency security policies and standards.
- Provide Data Owners with data protection status reports, as required by the Data Owner.

A template and example for a data protection status report is contained in Appendix C.

¹ IT system and data sensitivity classification is discussed in detail in the COV ITRM Risk Management Guideline (ITRM Guideline SEC507-00).
3 Data Storage Media Protection
The agency must document practices that it requires for data storage media protection. These practices should be in accordance with the agency’s and COV IT policies and standards.

3.1 Sensitive Data on Mobile Data Storage Media

3.1.1 Definition of Mobile Data Storage Media
Mobile data storage media include any data storage medium which may be easily transported by an individual without any special equipment. Mobile data storage media includes, but is not limited to:

- Portable External Hard Drives
- Laptops, tablet PCs, palmtop, or other mobile computers that contain an internal hard drive.
- Personal digital assistants and smartphones (e.g. Blackberry, Palm, Treo, and Windows Mobile devices)
- Compact and Digital Video Disks (CDs/DVDs)
- Floppy Disks
- Flash Drives (memory stick, USB drive, MMC, SD, and others)

3.1.2 Agency Head Approval
Sensitive data may not be stored on mobile data storage media without a documented agency business necessity and description of mitigating controls approved in writing by the Agency Head. All data storage media containing sensitive data must be both physically and logically secured. The approval must document the business reasons for accepting the risks to the data and a description of mitigating controls in place. Appendix A contains an example and template for Authorization to Store Sensitive Data on a Mobile Medium.

3.1.3 Logical and Physical Security of Mobile Data Media
Sensitive data requires multiple types of protection so that the confidentiality, integrity, or availability of data cannot be degraded by compromise of a single protection mechanism. For this reason, access to sensitive data stored on mobile data media must be both logically and physically secured. Figure 3 depicts this multi-layer protection.
a) Logical Security

Logical security includes IT protection mechanisms to limit users' access to information and to restrict their access levels based on the rule of least privilege\(^2\). Logical access controls are built into operating systems, and may be part of the logic of applications programs or database management systems. They may also be implemented by add-on security packages, such as Radius and Kerberos. Such packages are available for a variety of systems, including PCs and mainframes. Additionally, logical access controls may be present in specialized components, such as remote access servers, that regulate communications between computers and networks.

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\(^2\) The rule of least privilege states that access to data should be provided only to those who require it and to the extent they require it. For example, if a user has the need to view data but not change it, that user should be given read only access to the data, not read-write access. The rule of least privilege is often referred to as the “need to know.”
An example of logical security of data is the assignment of a power-on password to access a laptop computer. Implemented logical access controls should be geared to the risks to and sensitivity of the data.

b) **Physical Security**

Physical security includes physical protection mechanisms which restrict physical access to the data storage medium itself. An example of physical security of data is placing the medium in a locked office or file cabinet. The requirements for physical security of mobile storage media should be geared to the risks to and sensitivity of the data. Effective practices for physical security of mobile storage media include:

- Requiring use of locking security cables on mobile computers;
- Locking all offices where sensitive data is stored;
- Restricting the use of USB and Firewire based storage hard drives and flash drives; and
- Checking mobile storage media (for example, laptop PCs, CDs, DVDs, USB drives) in and out of agency facilities and documenting where the media is heading.

3.2 **Authorizing Physical Access to Data Storage Media**

Only authorized personnel are allowed to pick-up, receive, transfer, or deliver any data storage media containing sensitive data. In order to enforce this requirement, the agency should determine who is authorized, and how their access will be controlled.

3.2.1 **Authorization and Media Tracking**

To control physical access to data storage media, agencies should establish procedures to track custody. When service providers (delivery services, storage service providers, disaster recovery providers, etc.) have physical access to data storage media, the agency should work with the service provider to develop sets of procedures that:

- Validate authorizations; and
- Track custody.
Appendix D contains an example and template for Custody/Termination of Custody of Sensitive Data Storage Media.

3.3 Disposal and Reuse of Data Storage Media

If a data storage medium has become surplus, or it has reached the end of its service life and needs to be disposed of, the agency must follow, at a minimum, ITRM Standard SEC2003-02.1, *Removal of Commonwealth Data from State Electronic Equipment Standard*. A template for labeling data storage media for disposal may be found in SEC2003-02.1, Appendix A.

Magnetic and optical media cannot be cleansed of sensitive data simply by erasing or formatting the medium. Due to the physical properties of the medium and the disk technology, remnants of sensitive data may remain after erasure or formatting. To ensure complete removal of the sensitive data, overwriting, degaussing (in the case of magnetic media), or physical destruction of the medium is required. In cases of extremely sensitive information, a combination of two or more methods may be desirable. See Table 1 at the end of Section 3.3 for a comparison of the three methods.

3.3.1 Disposal of Data Storage Media

Agencies must dispose of data storage media by means of destruction when required by the Removal of Commonwealth Data from State Electronic Equipment Standard (SEC2003-02-1).

The two approved methods for disposal for data storage media are degaussing and physical destruction.

Degaussing uses an extremely powerful magnet to destroy a magnetic disk by completely randomizing its magnetic field properties. Degausses’ must be used with care, because the fields they generate can impair or destroy other electronic equipment. In most cases, degaussing technical requirements may be obtained from the manufacturer of the hard disk.

Physical destruction entails crushing, shredding, incinerating, perforating, or otherwise rendering the medium physically unable to be used. It is important to note physical destruction does not

---

3 In general, a disk is unusable after degaussing. It is important to note, however, that degaussing may not completely destroy all sensitive data on the magnetic medium, and that advanced forensic tools exist that may enable recovery of sensitive data from a magnetic disk that has been degaussed.
alter the magnetic properties of the data storage medium and that physical destruction must be conducted in such a way as prevent recovery of sensitive data.

3.3.2 Re-Use of Data Storage Media
If the medium is to be re-used (either because it is to be repurposed or surplus), one of the most proven ways to eliminate data from magnetic or optical media is overwriting the data. Overwriting simply means to write patterns of non-sensitive data (usually, simply binary ones and zeros) over the existing data. The method and complexity of the overwriting required may vary depending on the sensitivity of the original data. Typically, this variation takes the form of multiple iterations (or passes) of overwriting, and variations in the patterns of ones and zeros used.

Many operating systems have built-in overwriting mechanisms, and there are several commercial off-the-shelf tools available. A list of recommended tools may be found at http://www.vita.virginia.gov/library/default.aspx?id=5046.

Figure 4 illustrates the process of overwriting data. The ones and zeroes depict data that has been overwritten, while the other characters depict data that has not yet been overwritten. Table 1, which follows, summarizes data storage medium disposal methods; Figure 5 illustrates the data storage medium disposal process.
Figure 4 - Overwriting Process

01010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101010101
## Physical Destruction

<table>
<thead>
<tr>
<th>Optical, flash, magnetic media</th>
<th>Media will not be reused; and</th>
<th>Physical force (mangling)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Speed of data destruction is important</td>
<td>Incineration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disk surface perforation</td>
</tr>
</tbody>
</table>

### Figure 5 - Data Medium Disposal Process

All procedures must be in accordance with COV ITRM Standard SEC2003-02.1

1. **Will medium be reused?**
   - **Yes**: Overwrite medium
   - **No**: Is medium magnetic?
2. **Is medium magnetic?**
   - **Yes**: Degauss or Destroy
   - **No**: Destroy
4 Encryption

Encryption is the conversion of data into a form that is unreadable by an unauthorized user or process. Encrypted data must be decrypted (converted back to original form) prior to use. For most common encryption methods, a key is required for encryption and decryption. The major difference (from the users’ standpoint) between encryption methods is the type and management of the keys. Agencies should consider encryption as a means of protecting data, commensurate with sensitivity and risk. Especially useful for higher risk situations such as removable media including laptops. Figure 6 illustrates the process of selecting and managing data encryption technologies.
4.1 Types of Encryption

4.1.1 Data-At-Rest versus Data-In-Motion

There are two types of data that may require encryption. “Data-in-motion” is data that is in transit between two points, and may also be referred to as data in transmission. Data-in-motion comprises traffic moving over LANs, WANs, the Internet, etc. Another form of data-in-motion is transport of data via mobile media (e.g. flash drives, portable hard drives, laptops, etc.)
“Data-at-rest” is data at the end-points of the transmission. That is data stored in applications, files, databases, etc. Encryption of data-in-motion does not protect data-at-rest.

4.1.2 Where to Encrypt

Once the decision to encrypt data has been made, the Data Owner and System Owner should decide whether to implement encryption of data-in-motion, data-at-rest, or both. Before selecting data-in-motion, data-at-rest, or both, consideration should be given to:

- The sensitivity of the data and the risks to which it is subject;
- The amount of data requiring encryption;
- The frequency of changes to the data;
- The cost to implement a specific solution; and
- The burden the encryption may place on IT system users.

Table 2 outlines IT platforms where data may be encrypted and the benefits and drawbacks of each.

<table>
<thead>
<tr>
<th>Location</th>
<th>Cost</th>
<th>Benefits</th>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Relatively</td>
<td>May protect both &quot;data-in-motion&quot; &amp; &quot;data-at-rest&quot;, depending on application</td>
<td>Must be implemented for each application</td>
</tr>
<tr>
<td></td>
<td>inexpensive</td>
<td>Transparent to end users</td>
<td>May requires customization of application</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Does not interfere with lower level protocols</td>
<td>May require additional configuration of application</td>
</tr>
<tr>
<td>Host (Mainframe</td>
<td>Modestly</td>
<td>Protects all &quot;data-at-rest&quot; residing on the</td>
<td>Does not protect</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>Cost</td>
<td>Benefits</td>
<td>Drawbacks</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------</td>
<td>---------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Server)</td>
<td>expensive</td>
<td>server &amp; its storage&lt;br&gt;• Transparent to end users&lt;br&gt;• Does not interfere with lower level protocols</td>
<td>“data-in-motion”&lt;br&gt;• Must be implemented for each host&lt;br&gt;• Requires administration&lt;br&gt;• Creates additional host overhead</td>
</tr>
<tr>
<td>Network encryption&lt;br&gt;(Encryption of all network traffic through hardware or software)</td>
<td>• Moderately expensive</td>
<td>• Protects all data transiting the network&lt;br&gt;• Transparent to the end users&lt;br&gt;• Fewer encryption devices require less key management</td>
<td>• May interfere with network &amp; storage management protocols&lt;br&gt;• Does not protect “data-at-rest”&lt;br&gt;• Requires dedicated encryption devices, which require management</td>
</tr>
</tbody>
</table>
| Storage encryption<br>(Encryption of all data on a storage device such as SAN or laptop hard disk through hardware or software) | • Moderately expensive | • Protects all data residing on the storage device | • Does not protect “data-in-motion”<br>• Since all stored data is encrypted, non-sensitive data incurs burden of encryption<br>• May not be transparent to end-user; may require user training<br>• Encryption devices or
<table>
<thead>
<tr>
<th>Location</th>
<th>Cost</th>
<th>Benefits</th>
<th>Drawbacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>File encryption</td>
<td>• Moderately inexpensive to moderately expensive, depending on solution</td>
<td>• Protects files selected for encryption, avoiding burden of encrypting non-sensitive data</td>
<td>• Does not protect “data-in-motion”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Encryption devices or software require more management</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• May not be transparent to end-user; may require user training</td>
</tr>
</tbody>
</table>

4.1.3 **Private vs. Public Key Encryption**

Private key encryption is also known as shared key or symmetric encryption. In private key encryption, the encryption and decryption keys are the same. With private key encryption, the biggest challenge is sharing the keys themselves in a secure manner. This challenge is less of an issue with data-at-rest, because the key can be managed close to the storage medium, as, for example, when a hard disk needs encryption, encrypt all the data to be stored. Figure 7 outlines the operation of private key encryption.

**Figure 7 - Shared Private Key Encryption (Good fit for data-at-rest that will remain with one custodian.)**
Private key encryption, however, presents greater challenges when applied to data-in-motion. If two custodians of sensitive data wish to transmit data back and forth, the challenge becomes how to share the knowledge of the key without compromising the confidentiality of the key.

For example, if an agency headquarters in Richmond wishes to share data encrypted with its regional location in Big Stone Gap via its Wide Area Network, using private key encryption, the agency must find a means other than network to share the key, because the confidentiality of the key would be compromised if shared across the network. Sharing private keys via non-network means also provides challenges, as the confidentiality, integrity, and availability of the keys must be protected in transit, for example, by sending them via Registered U.S. Mail.

Public key or asymmetric encryption addresses these difficulties by encrypting the data with a public key that is defined by the receiver. The data is transmitted to the receiver, who then decrypts the data with the receiver’s private key, which is known only to the receiver. This encryption method works very well for data-in-motion, since no private key-sharing is required. Figure 8 outlines the operation of public key encryption.

Figure 8 - Public Key Encryption (Good fit for data-in-motion and custodian-to-custodian sharing of data.)
The challenge in administering public key encryption is managing the public keys. In a large agency, this task involves a significant commitment of resources. To address these challenges, encryption vendors have created public key infrastructure management systems.

### 4.2 Documentation of Agency Encryption Practices

Agencies must document their encryption practices. The documentation must establish:

- Agency practices for selecting and deploying encryption technologies
- Practices to determine when, what, and how to encrypt.
- How to respond to an incident when keys are compromised.
- How the agency will securely manage, administer, and distribute keys
- Requirements for the generation and secure storage of keys.

### 4.3 Key Management and Protection

There are inherent risks if proper key management procedures are not followed because of the complexity of distributing keys to all users in a synchronized fashion. The loss, theft, or compromise of encryption keys could seriously affect the integrity, confidentiality, and availability of agency data. Without proper handling of keys during their life cycle, keys could be disclosed, modified, or substituted by unauthorized personnel who could then intercept, modify, or destroy the sensitive data. This risk can be significantly mitigated through adequate key controls and proper education on encryption key management.

To protect keys or keying materials during their life cycle, guidelines providing detailed instructions or planned security measures must be available and followed. Since most encryption algorithms are published and well known, the security of data being transmitted is dependent upon the protection of the key. The destruction or loss of the key is equivalent to the loss or destruction of the data itself. If disgruntled employees or unauthorized users know that
Encryption keys are not changed regularly, more opportunities exist for encrypted communications to be monitored and broken over time.

Key management is the overall process of generating and distributing cryptographic keys to authorized recipients in a protected manner. Figure 9 illustrates the key management life cycle.

Figure 9 - Key Management

Encryption keys must be protected as sensitive data. Prior to deployment of encryption technologies, procedures to manage the keys must be developed and implemented. Key management systems and accompanying business processes can be obtained from most encryption vendors. Detailed guidance on key management can be found in NIST Special Publication 800-57, Recommendations for Key Management (http://csrc.nist.gov/CryptoToolkit/kms/SP800-57Part1_6-30-06.pdf).
4.3.1 Key Escrow
Key escrow is an arrangement in which the keys needed to decrypt encrypted data are held in escrow by a third party, so that someone else can obtain them to decrypt messages. The keys are securely protected by the third party who is prohibited from accessing the keys unless requested by the Data Owner. Implementing a key escrow agreement addresses the recovery of the keys in case of loss. Figure 10 illustrates the operation of key escrow.

Figure 10 - Key Escrow

4.4 User Training
Prior to deployment of an encryption system, users and administrators must be trained in the agency’s encryption policies and the use of the chosen encryption technologies. Most encryption vendors provide training for system administrators. Agencies should include user training on encryption technologies as part of initial and annual IT Security Awareness and Training.
5 Appendices
These Appendices provide examples and templates that agencies may use to document their use of many of the methodologies described in this Guideline. Each template consists of:

1) An example of the document, completed with fictional information; and

2) A blank version of the template for use by COV agencies.

The examples use different fonts for instructions and example information, as follows:

- Times New Roman text is used for the template itself.
- **Shaded Arial Bold text** is example text.
- *Times New Roman Italic text* is provided as instructions for completing the template.
Appendix A – Data Protection and Access Requirements

**Example**

<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Sensitive With Respect To</th>
<th>Required Special Protections</th>
<th>Access Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Confidentiality</td>
<td>Integrity</td>
<td>Availability</td>
</tr>
<tr>
<td>Employee Records</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permit Applications</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COOP Documents</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer Feedback</td>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Sensitive With Respect To</th>
<th>Required Special Protections</th>
<th>Access Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Confidentiality</td>
<td>Integrity</td>
<td>Availability</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Appendix B – Communicating Data Protection Requirements

**Example**

Communication of Data Protection Requirements

Date: **March 15, 2007**

Subject: **Protection of COOP Documentation Data**

Data Owner: **Steve Brown, COOP Coordinator**

System Owner: **Ann Lee, COOP Documentation System**

Please ensure the subject data is protected according to the requirements in the following table.

*Note: Paste the table from Appendix A into the memorandum from the Data Owner to the System Owner.*

<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Sensitive With Respect To</th>
<th>Required Special Protections</th>
<th>Access Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Employee Records</strong></td>
<td>X</td>
<td>Encrypted</td>
<td>Agency Head authorization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cannot leave the</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>agency headquarters</td>
<td></td>
</tr>
<tr>
<td><strong>Permit Applications</strong></td>
<td>X</td>
<td>Encrypted for</td>
<td>Two persons required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>transmission</td>
<td>to make changes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Agency Head</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>authorization</td>
</tr>
<tr>
<td><strong>COOP Documents</strong></td>
<td>X</td>
<td>Encrypted for</td>
<td>All agency employees</td>
</tr>
<tr>
<td></td>
<td></td>
<td>storage</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hard-copy backup</td>
<td></td>
</tr>
</tbody>
</table>
Communication of Data Protection Requirements

Date:

Subject:

Data Owner:

System Owner:

Please ensure the subject data is protected according to the requirements in the following table.

*Note: Paste the table from Appendix A into the memorandum from the Data Owner to the System Owner.*

<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Sensitive With Respect To Confidentiality</th>
<th>Integrity</th>
<th>Availability</th>
<th>Required Special Protections</th>
<th>Access Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix C – Data Protection Status Report

Example

Data Protection Status Report

Date: **April 19, 2007**

Subject: Protection of COOP Documentation Data

Data Owner: Steve Brown, COOP Coordinator

Data Custodian: Sam Brown, Director, Acme IT Data Services

This memorandum certifies that Acme IT Data Services has provided the required protection, documented below, to the subject data.

*Note: Paste the table from Appendix A into the memorandum from the Data Custodian to the Data Owner.*

<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Sensitive With Respect To</th>
<th>Required Special Protections</th>
<th>Access Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Confidentiality</td>
<td>Encryption</td>
<td>Agency Head authorization</td>
</tr>
<tr>
<td>Employee Records</td>
<td>X</td>
<td>Cannot leave the agency headquarters</td>
<td></td>
</tr>
<tr>
<td>Permit Applications</td>
<td>X</td>
<td>Encrypted for transmission</td>
<td>Two persons required to make changes</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>Hard-copy backup</td>
<td>All agency employees</td>
</tr>
<tr>
<td>COOP Documents</td>
<td>X</td>
<td>Encrypted for storage</td>
<td></td>
</tr>
<tr>
<td>Customer Feedback</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>
Data Protection Status Report

Date:

Subject:

Data Owner:

Data Custodian:

This memorandum certifies that Name of Data Custodian has provided the required protection, documented below, to the subject data.

Note: Paste the table from Appendix A into the memorandum from the Data Custodian to the Data Owner.

<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Sensitive With Respect To</th>
<th>Required Special Protections</th>
<th>Access Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Confidentiality</td>
<td>Integrity</td>
<td>Availability</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Appendix D – Authorization to Store Data on a Mobile Data Storage Medium

May 30, 2007

I hereby, authorize the storage of Budget Formulation System (BFS) Agency Budget Plans on USB “flash” drives by Analysts in the BFA Budget Analysis Section. I recognize the data is sensitive, and accept the risks of storage on the named medium. The business reasons driving this requirement are the needs to:

a) Allow Budget Analysts to work remotely to implement COV telework initiatives;
b) Provide for physical transport of data to other agencies for use in budget review sessions; and

c) Provide access to the data from BFA computers not connected to the BFA network.

The mitigating controls in place are agency polices that require:

a) All USB “flash” drives to be protected with strong passwords; and

b) Full disk encryption of USB “flash” drives used to store sensitive data; and

C) BFA employees to keep USB “flash” drives that contain sensitive data under their physical control at all times.

This authorization expires one year from the date above.

John Davis
Director
Budget Formulation Agency
Data

I hereby, authorize the storage of __________ Data to be stored __________ on __________ Data storage medium __________ by __________ Individuals authorized to store data __________. I recognize the data is sensitive, and accept the risks of storage on the named medium. The business reasons driving this requirement are the needs to:

a) __________ First reason __________
b) __________ Second reason __________
c) __________ Third reason __________

Add additional reasons, as required

Mitigating controls in place are:

a) __________ First mitigating control __________
b) __________ Second mitigating control __________
c) __________ Third mitigating control __________

Add additional mitigating controls, as applicable

This authorization expires one year from the date above.

________________________
Agency Head Name

________________________
Agency Head Title

________________________
Agency Name
Appendix E – Custody/Termination of Custody of Sensitive Data Storage Media

Example

May 30, 2007

I hereby, authorize Partner Services, Inc. (PSI) to maintain custody of Budget Formulation System (BFS) backup data on magnetic tape cartridges. I recognize the data is sensitive, and accept the risks of authorizing this custody.

This authorization expires one year from the date above, or upon execution of the termination portion of this agreement.

Mike Williams
Budget Analysis Manager
Budget Formulation Agency

Authorization of custody is hereby terminated.

Mike Williams
Budget Analysis Manager
Budget Formulation Agency

November 15, 2007
I hereby, authorize _________________ Data Custodian _________________ to maintain custody of _________________ Data for which custody is authorized _________________ on _________________ Specific data storage media _________________. I recognize the data is sensitive, and accept the risks of authorizing this custody.

This authorization expires _________________ Period for which custody is authorized _________________ one year from the date above, or upon execution of the termination portion of this agreement.

Authorization of custody is hereby terminated.

______________________________
Data Owner Name

______________________________
Data Owner Title

______________________________
Agency Name

______________________________
Termination Date